REMARKS

Claims 1-7 and 9-22 remain pending in this application. Claims 9, 21 and 22 are withdrawn. Claims 1-8 and 10-20 are rejected. Claims 10-12 are objected to. Claim 8 is cancelled. Claims 1-4, 7, 10 and 14 are amended herein to address matters of form unrelated to substantive patentability issues. New claims 23 and 24 are added.

Applicant herein traverses and respectfully requests reconsideration of the rejection of the claims and objections cited in the above-referenced Office Action.

The Examiner alleges that the Information Disclosure Statement filed on February 17, 2005 fails to comply with 37 CFR 1.98(a)(1). Applicant respectfully disagrees with the Examiner's interpretation of the Rules, and submits the following. The filing on February 17, 2005 constituted submission of a copy of the International Preliminary Examination Report-Supplement dated August 30, 2004 in which eight references are listed. As noted in the Supplemental IDS, all eight references were previously submitted to the Patent Office in an earlier IDS dated September 30, 2004, in which a listing thereof in a suitable format in full compliance with the requirements of 37 CFR 1.98(a)(1) was provided. Thus, applicant respectfully requests that the content of the Supplemental IDS filed February 17, 2005 be fully considered, and notice to that effect be given in a subsequent Office Action.

Claims 10-12 are objected to as depending from non-elected claim 9. Claim 10 is amended to depend from elected method claim 1, rather than withdrawn claim

9, thereby mooting the objection. Withdrawal of the objection is earnestly solicited.

Claims 1-8 and 10-20 are rejected as indefinite under 35 U.S.C. § 112, second paragraph, for failing to particularly point out and distinctly claim the subject matter of the invention as a result of informalities stated in the Office Action. The claims are amended to remove or correct the informalities noted in the Office Action. However, with regard to the subject matter of claim 8, now incorporated into claim 1, applicant respectfully submits the following remarks.

The Examiner's statement that the claim language is unclear regarding how the specific mechanical energy (SME) is introduced (whether at the beginning, end or throughout the mixing) ignores the definition of SPE, which value represents a ratio of the net mechanical energy input to the total mass flow rate. Applicant submits herewith a copy of pages 92 and 93 of the book "Extrusion cooking Technologies and applications, Edited by Robin Guy, in which the SME is explained for the Examiner's edification.

Applicant further disagrees with the Examiner's position that the claim recitation need be limited to a either a SME value which is maintained constant throughout the mixing process or a variable value within the claimed range. Applicant respectfully submits that there is nothing indefinite about having a claim with a breadth of coverage that embraces both contingencies, and knows of no rule dictating otherwise, as the Examiner avers.

Therefore, based upon the foregoing, reconsideration of the rejection of claims 1-8 and 10-20 and their allowance are earnestly requested.

Claims 1-3, 7, 10, 12, 13, 15 and 20 are rejected under 35 U.S.C. § 102(b) as being anticipated by Dudacek (US 6,001,408). Applicant herein respectfully traverses these rejections. "Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, *arranged as in the claim.*" ***Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.***, 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added). It is respectfully submitted that the cited reference is deficient with regard to the following.

Independent claim 1 is amended to incorporate the subject matter of claim 8, cancelled herein as now being redundant. The subject matter of claim 8 has not been determined by the Examiner as being anticipated by the Dudacek reference. In this regard, the Office Action at page 5, last two paragraphs, states that "Dudacek is silent with respect to a specific mechanical energy of 120 to 220 Wh/kg being introduced into the product."

In view of the above, it is respectfully submitted that claims 1-3, 7, 10, 12, 13, 15 and 20 as amended particularly describe and distinctly claim elements not disclosed in the cited reference. Therefore, reconsideration of the rejections of claims 1-3, 7, 10, 12, 13, 15 and 20 and their allowance are respectfully requested.

Claims 1, 3, 4, 10, 12-14, 16, 17 and 20 are rejected under 35 U.S.C. § 102(b) as being anticipated by Protzman (US 3,137,592). Applicant herein respectfully traverses these rejections.

As discussed above, independent claim 1 is amended to incorporate the subject matter of claim 8, which has not been determined by the Examiner as being anticipated by the Protzman reference.

In view of the above, it is respectfully submitted that claims 1, 3, 4, 10, 12-14, 16, 17 and 20 particularly describe and distinctly claim elements not disclosed in the cited reference. Therefore, reconsideration of the rejections of claims 1, 3, 4, 10, 12-14, 16, 17 and 20 and their allowance are respectfully requested.

Claims 8, 11 and 19 are rejected as obvious over Dudacek under 35 U.S.C. §103(a). The applicant herein respectfully traverses this rejection. For a rejection under 35 U.S.C. §103(a) to be sustained, the differences between the features of the combined references and the present invention must be obvious to one skilled in the art.

As noted above, the subject matter of claim 8 is now incorporated in claim 1. Therefore, the arguments presented with regard to these rejections will be presented herein in support of newly amended claim 1, and all claims dependent therefrom. With regard to the subject matter of claim 8 (amended claim 1) , the Examiner states that the selection of the specific mechanical operational discharge of energy of 120 – 220 Wh/kg is considered to be obvious, since one skilled in the

art would select the operational discharge of energy according to the viscosity of the mixture to be extruded. However, applicant respectfully submits that in addition to merely viscosity related considerations, such a high operational discharge of mechanical energy is necessary in order to make sure that through the pressure release at the emersion from the extruder, a sufficient amount of water evaporates, so that the emerging extudate can air dry without any additional special drying effort (please see disclosure at paragraph [0009] of the published application). This inherent characteristic, owing directly to the specially claimed ranges of relatively high temperature and SME, would not be readily obtained without the benefit of the instant disclosure (and as reflected in the claims as amended). The ability to utilize air-drying without the use of further resources is never mentioned in any of the references cited by the Examiner.

Thus, it is respectfully submitted that the rejected claims are not obvious in view of the cited reference for the reasons stated above. Reconsideration of the rejections of claims 8, 11 and 19 and their allowance are respectfully requested.

Claims 5, 6 and 18 are rejected as obvious over Dudacek in view of Neisser et al. (DE 4344139) under 35 U.S.C. §103(a). The applicant herein respectfully traverses this rejection.

The subject matter of claim 8 incorporated into claim 1, from which claims 5, 6 and 18 depend moots this rejection, since the recitation of claim 8 discussed above is not taught or suggested in either the Dudacek or the Neisser reference.

Thus, it is respectfully submitted that the rejected claims are not obvious in view of the cited reference for the reasons stated above. Reconsideration of the rejections of claims 5, 6 and 18 and their allowance are respectfully requested.

Dependent claim 23 is added and is submitted as patentable over the cited art of record based on the subject matter cited therein in addition to the subject matter of claim 1.

Applicant respectfully requests a one (1) month extension of time for responding to the Office Action. Please charge the fee of $130 for the extension of time to Deposit Account No. 10-1250.

The USPTO is hereby authorized to charge any fee(s) or fee(s) deficiency or credit any excess payment to Deposit Account No. 10-1250.

In light of the foregoing, the application is now believed to be in proper form for allowance of all claims and notice to that effect is earnestly solicited.

Respectfully submitted,
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cooking is an ideal method for manufacturing a number of food products from
d breakfast cereals to baby foods. However, as a complex multivariate process it
areful control if product quality is to be maintained. Edited by a leading
n the field, and with an international team of contributors, this important
reviews some of the key factors affecting quality and how they can be controlled
cturing a range of extruded products.

art of the book looks at general influences on quality. There are chapters on the
f raw materials, criteria for selecting the right extruder, analysing and
thermal performance in extrusion cooking, and effective process control. There
important chapter on maintaining nutritional quality in extruded products. The
rt of the book looks at how these variables affect specific extruded products,
ers on breakfast cereals, snack foods and baby foods.

cooking will be widely welcomed as a key reference in maximising the quality of
products.

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Hall

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dhead-publishing.com
573 559 8

CRC Press LLC
2000 Corporate Blvd, NW
Boca Raton
FL 33431
USA
CRC order number WP1207
ISBN 0-8493-1207-8

CRC

WOODHEAD PUBLISHING LIMITED

Extrusion cooking

L 9141

Extrusion cooking

Technologies and applications

Edited by Robin Guy

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ETHICS ETH-BIB
00100004165789

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The screw speed affects the residence time, the amount of shear introduced, the melt viscosity, amount of frictional energy generated and the barrel fill. The water injection rate determines the barrel moisture content, which in turn controls the frictional energy generated, and the melt viscosity. The feed rate controls the energy generated, the residence time and the barrel fill. The temperature profile of the barrel affects the product temperature, which in turn affects degree of cook and the melt viscosity. The barrel temperature is controlled by external heating systems (electrical conduction heating, hot oil, steam or electrical induction, depending on the type of extruder). In some extruders, thermal energy is added to the product by direct steam injection. If necessary, heat could be removed from the extruder barrel by circulating cooling water.

5.3.2 Controlled variables

There are four main controlled variables in an extruder. These are:

- specific mechanical energy
- die melt temperature
- die pressure
- flow rate through the die.

The specific mechanical energy (SME) is defined as follows.

$$\text{SME} = \frac{\text{Total energy}}{\text{Flow rate}}$$

If there is no external heat applied, the total energy is equal to the heat generated by friction. Otherwise, the external heat applied should also be included.

As mentioned in section 5.3.1, the die melt temperature (and the die pressure) can be controlled from the manipulated process variables. The flow rate through the die can be calculated by dividing the total flow rate through the extruder by the total cross-sectional area of the die.

5.3.3 The importance of good design and controlling the key control points

The objective of controlling an extrusion system is to control the product quality and the consistency of quality. Before attempting to control the extruder, it is important to design the whole extrusion system (including pre- and post-processing) correctly. The extrusion process must be regarded as an integrated process involving formulation of raw materials, pre-processing, processing in the extruder (including the die) and post extrusion processing. In order to obtain the required product quality, the whole system has to be properly controlled.

As far as the extrusion process is concerned, it is generally true that for a given formulation, screw configuration and die design, if the main process variables (feed rate, screw speed, water injection rate, barrel temperature profile and the speed of the rotating knife) are controlled properly, the controlled

variables (SME, die temperature, die pressure and flow rate through the die) will be maintained at the desired values. This will produce a good product consistently.

One of the most common causes of non-uniform product is instability in the extruder. This is caused by the emptying of the barrel. This happens when the screw speed is too high relative to the feed rate. Therefore it is important to control the feed rate and screw speed properly so that the barrel is not empty or flooded (a phenomenon that occurs when the screw speed is too low relative to the feed rate). It is recommended that an accurate gravimetric powder feeder be used so that a constant mass flow rate is obtained even if the bulk density of the raw materials varies. It is equally important to have a good pump to inject water into the extruder barrel because even a small fluctuation in the water rate could have a significant impact on product quality.

5.4 Instrumentation

Measurement of key variables is essential for control. Without these measurements there can be no control. Typically, extruder instrumentation consists of an ampere meter to estimate drive motor power, simple solid and liquid ingredients feeding systems and associated flow meters, a thermocouple to measure die melt temperature and observation at the discharge end to estimate product quality.

The amount of instrumentation that is appropriate for any particular extrusion application depends on the economics of the product and the ability to use the information that is generated from the instruments. More sophisticated extrusion systems will have the feed and liquid ingredients tightly monitored and controlled. In addition, a range of thermocouples along the barrel and at the die assembly may be encountered. In some cases, a pressure transducer will be found at the die. A very brief review of existing sensors is given in section 5.4.1. Any number of instrumentation suppliers will be able to provide reams of information about these instruments. Our focus will be on novel sensors, which offer something different from the standard instruments.

5.4.1 Existing sensors

Powder feed rate

Powder feed rate is typically measured by a volumetric feeder. That is, the volume of material fed to the extruder is maintained at a specific amount. However, slight feed rate disturbances due to bulk density changes can cause significant disruption to the extruder. There are a number of alternative volumetric feeder types:

- *Single screw feeder.* Most common, volumetric rate is proportional to screw speed.